iii. Front-End Systems

Various device control modules will comprise the hardware interface between accelerator equipment and the controls system. Device control modules may either be local to the FEC, that is, connected directly to the FEC VME bus or they may be remote from the FEC connected to the FEC via a field bus. Device control modules may be standard commercial modules, or they may be general control modules built by the Accelerator Controls Section or special-purpose control modules built by other groups.

Device control modules provide the primary buffering of data on input and furnish reference data and commands to the equipment on output. Where needed, electrical isolation will be provided between the accelerator equipment and the front-end computer. Responsibility for this isolation will be negotiated on a case by case basis. Each front-end computer system will be configured with sufficient non-volatile memory to preserve device configuration and settings across reboots. UPS will be provided as needed to reduce the frequency of reboots due to brief power dips.

Approximately ten modules for the RHIC control system will be designed and built by the Accelerator Controls Section. Control modules will be built for power supply control, links interface (events, digital data, beam sync clock and permit links) and signal acquisition. These will all be local device control modules connecting directly to the VME bus in the FEC. The design of several of these modules will follow the functionality of similar modules designed and built at FNAL.

Analog signal acquisition will be provided by a general purpose ADC system that will be supplied by the Accelerator Controls Section. The ADC system will include a direct input from the RHIC event line enabling the system to schedule data acquisition for selected channels based on timing events. The system will have a mode that can be used to continuously display "scope traces" of slow signals at consoles. A flight recorder mode will also be provided to halt data acquisition upon a beam abort to assist in "post mortem" analysis.

Power supply control and reference functions will be calculated in real time by a generic waveform generator board. This module will generate functions derived from both time and energy dependent parameters. Tables of parameters used in the calculation are

Table 9-2. Subsystem Controls Summary

Subsystem	Equipment	Location	Interface
Timing & Links	Clocks, data link masters	1004 service bldg.	VME
	Permit link master	1010 service bldg.	VME
Instrumentation	Ring BPMs, BLMs	Alcoves, service bldgs.	VXI
	Inj. line BPMs, BLMs, beam transformers, flags	Transfer line bldgs. & injection bldgs.	VXI,GPIB
	Special Instrumentation	1002 support bldg.	VXI,GPIB
Power Supplies	Main Dipole	1004 service bldg.	VME
	Main Quad	1004 service bldg.	VME
	Correctors	Alcoves	VME
	Insertion Dipoles, Quads	service bldgs.	VME
	Gamma Jump	service bldgs.	VME
	Injection Line	Injection bldgs. & transfer line bldgs.	VME
RF Systems	High & low level	1004 service bldg.	VME
Vacuum	Pumps/valves/gauges	service bldgs.	VME

selected by events received from the RHIC event link from 16 sets stored on-board. Energy dependent data required by the module is received directly from the RHIC Real Time Data Link (cf. Sect. iv). Time dependent terms in the reference function are updated at rates up to 10 kHz while energy dependent terms are updated at the RTDL rate of 720 Hz.

VME or VXI control modules for some of the RF control will be built by the RF group. The instrumentation group will build specialized VXI modules for some of the beam instrumentation.

When a device control module is connected to the FEC via a field bus, a field bus controller is needed in the front-end computer. Field bus controllers and driver software for VME are available commercially. A summary of interface characteristics for the various subsystems is given above.